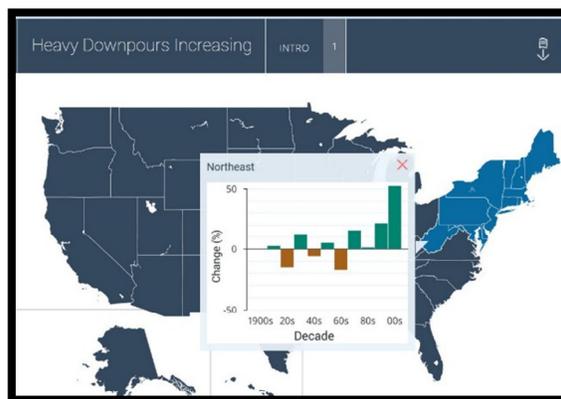
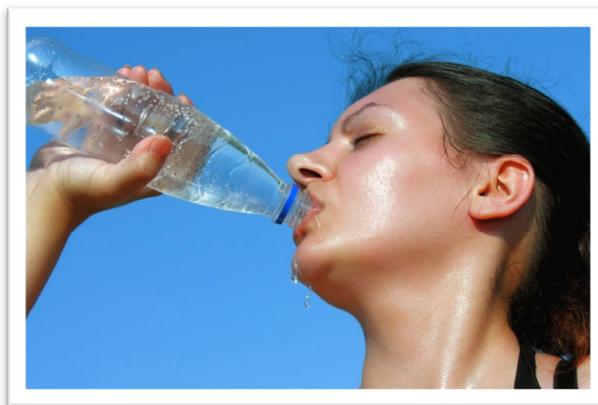
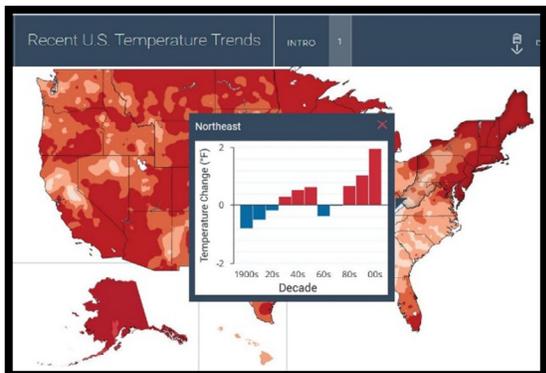


# Health & Climate Change in New Hampshire's Lakes Region: An Action Plan



February 2016

Lakes Region Partnership for Public Health

With assistance from the

Lakes Region Planning Commission

This report was developed by the Partnership for Public Health (PPH) with assistance from the Lakes Region Planning Commission with funding provided by the Centers for Disease Control (CDC) administered by the New Hampshire Department of Health and Human Services (DHHS). This is a pilot program that will guide action at the local and regional level. Two awards were made in the state and New Hampshire was one of 18 states awarded these funds.

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Cover image sources:

Recent US Temperature Trends: <http://nca2014.globalchange.gov/report/our-changing-climate/recent-us-temperature-trends>

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Black-legged ticks: <http://www.askdrmaxwell.com/wp-content/uploads/2014/10/lyme-disease-deer-tick-photo-300x204.png>

Heavy Downpours Increasing: <http://nca2014.globalchange.gov/report/our-changing-climate/heavy-downpours-increasing>

Health & Climate Change in New Hampshire's Lakes Region: An Action Plan

Table 1. List of Acronyms

<b>Acronym</b>	<b>Meaning/Organization</b>
CCNTR	Caring Community Network of the Twin Rivers
CDC	Centers for Disease Control and Prevention
CERT	Citizens Emergency Response Team
DES	NH Department of Environmental Services
DHHS	NH Department of Health and Human Services
EEE	Eastern Equine Encephalitis
EMD	Emergency Management Director
EPA	US Environmental Protection Agency
LRGH	Lakes Region General Hospital
LRPC	Lakes Region Planning Commission
PHAC	Public Health Advisory Council
PHN	Public Health Network
PPH	Partnership for Public Health
VNA	Visiting Nurse Association
WPHR	Winnepesaukee Public Health Region
WNV	West Nile Virus

Health & Climate Change in New Hampshire's Lakes Region: An Action Plan

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## Contents

1. Executive Summary .....	1
2. Introduction.....	2
3. Local/regional vulnerability assessments (severe weather, climate, health).....	4
4. Regional health risks and vulnerable populations .....	8
5. Goals, objectives, strategies, and implementation.....	20
Appendix A - Resources.....	24

## 1. Executive Summary

New Hampshire's Lakes Region is a great place to live, work, and play with its abundant natural resources and variable seasons. Warm summer days on the lake, crisp autumn days in the woods, and snowy winter weekends on the slopes. It's no wonder that the region's economy is so closely linked with seasonal tourism. Some changes occurring in the region's climate could; however, impact the health and quality of life of many of the region's residents and visitors.

This project was initiated by the Partnership for Public Health; it is one portion of a multi-part effort to advance Public Health Initiatives funded by the Centers for Disease Control through a competitive grant program administered and supported by the NH Department of Health and Human Services. The ultimate goal of the project is to create a region that is more aware of and resilient to the regional impacts of a changing climate. As a pilot project, this plan and the process are also intended for use as a model upon which other regional health networks might learn from and build subsequent efforts.

Methods used to complete this planning process began with research of available data sources. This included information about local and regional hazards, existing climate indicators and anticipated changes, along with the populations most vulnerable to the impacts of these changes. This information was presented to regional Health and Emergency Response committees for feedback, discussion, and prioritization.

With the anticipated increase in the number of days with extreme heat and shorter, less severe winters (extending the tick season), the planning process led to the prioritization of heat stress and Lyme disease as the primary health impacts to focus on for this plan. Ultimately, this was narrowed to focus solely on Lyme disease. Four goals and a number of strategies to achieve them were identified.

The second phase of this grant-funded process is to begin implementation of the prioritized actions. Some short-term actions should be achievable along with establishing the foundation for some of the medium- and long-term actions during the second phase, but these are limited due to time and funding constraints. Further efforts will be required to carry these strategies through to completion.

## 2. Introduction

The climate of northern New England is changing and models indicate that these changes will continue over the next several decades<sup>1</sup>. Changes such as more days with extreme heat, shorter winters, and heavier rainfalls will impact the plants, animals, and people of New Hampshire's Lakes Region. There are substantive implications for the health of many of the region's residents and visitors, putting added pressure on the region's public health and emergency response resources.

In order to better understand our regional vulnerability to climate/weather, improve preparedness planning, and reduce negative health impacts this Health and Climate Change Action Plan has been developed. This is the first step in the planning process. Steps included:

- identification of environmental exposures and weather hazards,
- identification of health effects and impacts,
- documentation of baseline public health data,
- setting of goals for health impact reductions, and
- identification of an intervention and supporting activities.
- At a couple of points in the process, prioritization occurred to maintain focus and ensure that the resulting actions were ones that are important to the region.

Having identified and prioritized regional environmental exposures, the health impacts, and various interventions, the next steps will be to begin implementing interventions appropriate to the local communities and documenting their effectiveness.

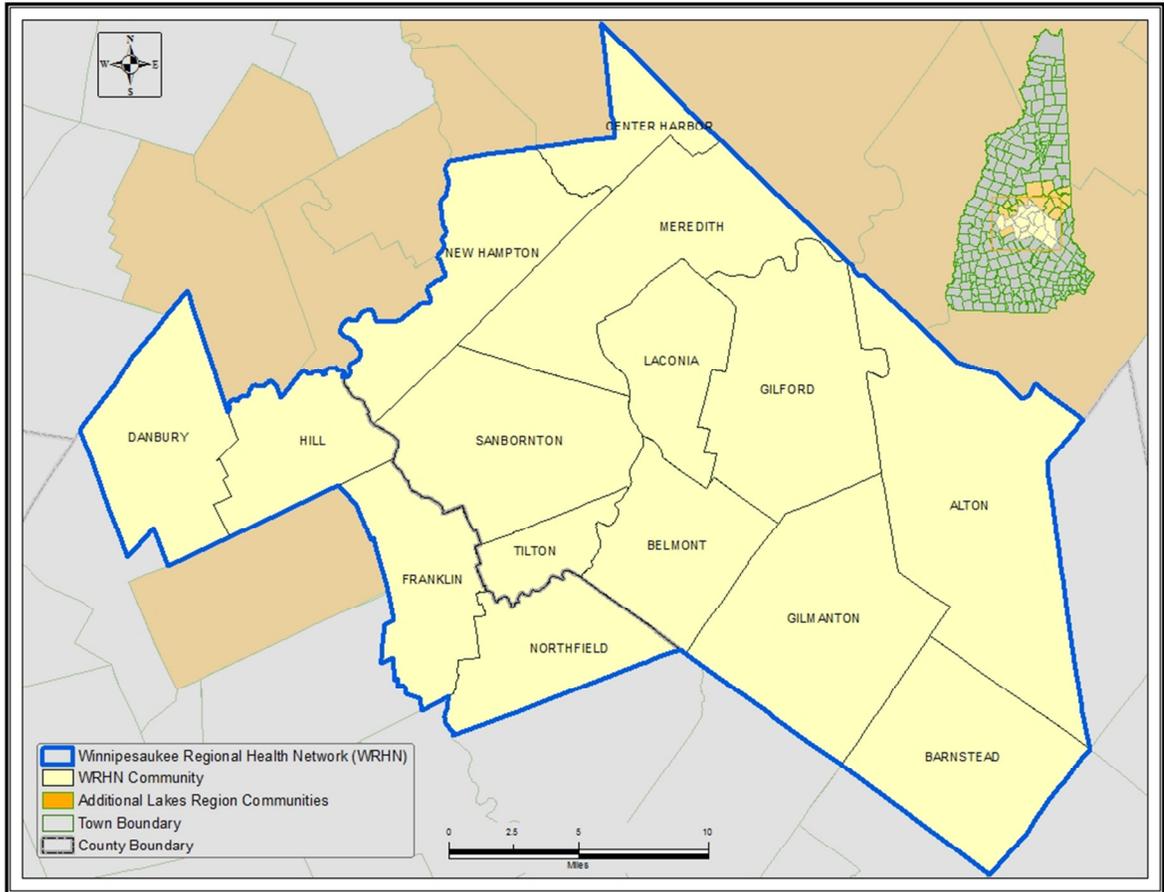
Guidance, resources, and overall structure were provided through the New Hampshire Department of Health and Human Services (DHHS). The Partnership for Public Health (PPH) managed the grant and facilitated stakeholder input, and the Lakes Region Planning Commission (LRPC) conducted research of local and regional information and developed the planning document.

New Hampshire's Lakes Region is a mostly rural region in the central part of the state, comprised of 28 towns and two small cities, Laconia and Franklin. As foothills to the White Mountains, the landscape is generally hilly and contains 40% of the state's surface water in Lake Winnepesaukee and other large lakes. Throughout much of its history, the region's economy has consisted of a mix of agriculture, industry, and tourism. Today the region relies heavily on the tourism industry. The Lakes Region Planning Commission (LRPC) works with these communities on a variety of land use, transportation, economic development, and natural resources issues. The Winnepesaukee Public Health Region (WPHR) is comprised of fifteen of the communities in the LRPC region, partnering with numerous health and social service

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<sup>1</sup> *National Climate Assessment (2014)* <http://nca2014.globalchange.gov/> and *Climate Change in Southern New Hampshire: Past, Present, and Future (2014)* Wake, et.al. [https://www.climatesolutionsne.org/sites/climatesolutionsne.org/files/unhsi-csne-southernnh\\_climateassessment\\_june\\_4\\_2014.pdf](https://www.climatesolutionsne.org/sites/climatesolutionsne.org/files/unhsi-csne-southernnh_climateassessment_june_4_2014.pdf).

organizations to help people understand and address pressing health issues throughout the region.



**Figure 1: The Winnepesaukee Public Health Region**

With input and support from local/regional stakeholders, the specific study areas were focused on Laconia and Franklin, the two small cities in the Lakes Region. Reasons for this decision included demographics, income levels, presence of medical facilities, and availability of data.

The goals, objectives, and strategies at the end of this document are intended as a guide for implementing steps that will help the region become more resilient to anticipated changes. The intended audience for this report is local and regional planners and public health professionals.

### 3. Local/regional vulnerability assessments (severe weather, climate, health)

#### 3.1. Historical information

Several recent composite reports document changes in the region's climate over a number of decades. The focus area ranges from the entire US to New England and even sub-regions of New Hampshire. The patterns are clear; New Hampshire is becoming warmer and wetter with more severe weather. Specific patterns that have been detected in the region include:

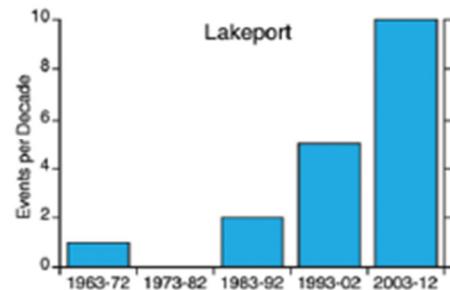
- Warmer temperatures

Overall temperatures have been increasing in southern New Hampshire, especially in the years since 1970. While some parts of the Northeast are experiencing more heat waves, New Hampshire has seen substantive increases in winter temperatures, including fewer days below freezing. This has resulted in less snow cover in the winter and longer growing seasons (see last row in Tables 1 and 2)<sup>2</sup>.

- More heavy precipitation events

According to Tables 1 and 2, the number of extreme precipitation events per decade (defined as four or more inches of precipitation in a 48-hour period) between 1980 and 2009 in the Lakes Region was about 3.3. Figure 2 however, illustrates that this number has not be static but has been increasing. In Laconia (Lakeport<sup>3</sup>), the number of extreme precipitation events has shown a clear increase in the number of these events.<sup>4</sup>

**Weather** is the hourly and daily changes in local conditions such as temperature, precipitation, humidity, and wind.  
**Climate** is the average of these indicators over an extended timeframe, a 30-year time span is frequently used for this purpose.



**Figure 2: Trends in extreme precipitation events per decade in Laconia (> 4" in 48 hours), 1963 - 2012**

#### 3.2. Modeling

Models are utilized in a variety of fields to project what future conditions might be based on known information and assumptions. Whether modeling economic activity, population growth, or next week's weather, different models (with different assumptions) can often result in somewhat differing outcomes, though often trending in similar directions. Both the

<sup>2</sup> *Climate Change in Southern New Hampshire: Past, Present, and Future (2014) Wake, et.al.*  
[https://www.climatesolutionsne.org/sites/climatesolutionsne.org/files/unhsi-csne-southernnh\\_climateassessment\\_june\\_4\\_2014.pdf](https://www.climatesolutionsne.org/sites/climatesolutionsne.org/files/unhsi-csne-southernnh_climateassessment_june_4_2014.pdf), pp. 12-14.

<sup>3</sup> Lakeport is a village near downtown Laconia that has long-term weather records which are a good representation for the city's weather.

<sup>4</sup> *Ibid.*, p. 17.

## Health & Climate Change in New Hampshire's Lakes Region: An Action Plan

*National Climate Assessment*<sup>5</sup> and *Climate Change in Southern New Hampshire: Past, Present, and Future* explored the results from a variety of climate models to project what the climate will be like by the end of the century.

The NH-specific model developed short-, medium-, and long-term projections under both a low-emissions scenario (reduced carbon emissions) and a high-emissions scenario (no change in carbon emissions), shown in Tables 1 and 2<sup>6</sup>.

**Table 1: Various climactic indicators: Historical values and anticipated changes Lakeport (1), New Hampshire**

Indicators	Historical* 1980-2009	Change from historical (+ or -)					
		Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099	
		Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
<b>Temperature Extreme (days per year)</b>							
<32°F	152	-9	-10	-15	-23	-18	-38
<0°F	12	-4	-4	-6	-9	-7	-11
>90°F	5	3	4	9	18	15	43
>95°F	0	1	1	2	4	3	16
TMAX on hottest day of year	92.2	1.8	1.1	3.0	4.7	4.3	9.0
TMIN on coldest day of year	-13.2	3.6	4.2	5.6	9.6	7.4	16.5
<b>Growing Season (days)</b>	188	10	11	14	26	21	40
<b>Extreme Precipitation (events per year)</b>							
1" in 24 hrs	9.1	1.5	1.2	2.0	2.5	2.7	4.1
2" in 48 hours	3.7	1.4	0.8	1.7	1.8	2.4	3.8
<b>Extreme Precipitation (events per decade)</b>							
4" in 48 hours	3.9	1.5	0.3	2.4	2.8	4.1	4.9
<b>Snow-Covered Days</b>	112	-14	-16	-21	-39	-32	-58

<sup>5</sup> *National Climate Assessment (2015)*, <http://nca2014.globalchange.gov/>.

<sup>6</sup> *Climate Change in Southern New Hampshire: Past, Present, and Future (2014)* Wake, et.al. [https://www.climatesolutionsne.org/sites/climatesolutionsne.org/files/unhsi-csne-southernnh\\_climateassessment\\_june\\_4\\_2014.pdf](https://www.climatesolutionsne.org/sites/climatesolutionsne.org/files/unhsi-csne-southernnh_climateassessment_june_4_2014.pdf). Appendix B.

**Table 2: Various climactic indicators: Historical values and anticipated changes**

Franklin, New Hampshire							
Indicators	Historical* 1980-2009	Change from historical (+ or -)					
		Short Term 2010-2039		Medium Term 2040-2069		Long Term 2070-2099	
		Low Emissions	High Emissions	Low Emissions	High Emissions	Low Emissions	High Emissions
<b>Temperature Extreme (days per year)</b>							
<32°F	164	-9	-11	-15	-25	-18	-43
<0°F	18	-5	-5	-9	-12	-10	-16
>90°F	14	7	7	17	29	24	57
>95°F	2	3	2	7	12	12	32
TMAX on hottest day of year	95.8	2.2	1.4	3.2	5.4	5.6	9.8
TMIN on coldest day of year	-20.2	5.0	5.8	7.4	12.6	9.9	20.6
<b>Growing Season (days)</b>	160	12	15	17	31	19	52
<b>Extreme Precipitation (events per year)</b>							
1" in 24 hrs	7.7	1.7	1.2	1.8	2.0	2.3	3.2
2" in 48 hours	3.3	1.1	0.6	1.4	1.4	1.9	2.9
<b>Extreme Precipitation (events per decade)</b>							
4" in 48 hours	3.3	1.3	-0.2	1.1	2.5	3.1	3.6
<b>Snow-Covered Days</b>	105	-14	-14	-20	-37	-30	-54

In most scenarios, each of the climatic changes identified below is projected to be exacerbated.

- More heat waves*

As described in the tables above, currently both Laconia and Franklin experience a relatively small number of days where the temperature rises above 90°F or 95°F (Laconia 5 days above 90°F/0 days above 95°F and Franklin 14 days above 90°F/2 days above 95°F). These rates are expected to increase in both cities over the next twenty years (Laconia 8-9 days above 90°F/1 day above 95°F and Franklin 21 days above 90°F/4-5 days above 95°F) and even under the most conservative scenario, by the end of the century city officials and health planners in both cities should expect to see far more extreme heat days (Laconia 15 over 90°F/3 over 95°F and Franklin 24 over 90°F/12 over 95°F). Higher temperatures may put local and tourist populations at greater risk for heat stress.
- Fewer days below freezing (32°F)*

Currently these Lakes Region communities experience daily low temperatures below freezing during 22-23 weeks of the year. City planners can expect the number of days below freezing to drop by about ten days over the next twenty years and an additional one to four weeks by the end of the century.
- Less winter snow cover*

The average number of weeks with snow cover in the region is 15-16 at present. That figure, too, is projected to shrink by two weeks over the next couple of decades and

## Health & Climate Change in New Hampshire's Lakes Region: An Action Plan

four to five weeks by the end of the century under the most conservative scenario, or about eight weeks under the more extreme scenario.

- Longer growing season

In large part due to the large bodies of water in and around Laconia, it has a substantially longer growing season than Franklin (27 weeks vs. 23 weeks). Both communities should expect an additional one and a half to two weeks of growing time by 2040 and somewhere between three and seven weeks more by the end of the century.

- More heavy precipitation events

The current rate of 3-4 extreme precipitation events, defined as four inches in 48 hours, per decade<sup>7</sup>, is projected to increase slightly over the next twenty years and double by the end of the century.

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<sup>7</sup> Three to four extreme precipitation events per decade is referenced in the Lakeport, NH table when looking at data from 1980-2009. Figure 2 showing events per decade shows that the number of events per decade has already increased to well above this 30-year average.

#### 4. Regional health risks and vulnerable populations

##### 4.1. Process used for identification and prioritization

Staff from PPH and LRPC reviewed weather and climate data including references in local hazard mitigation plans and this was discussed with colleagues from the Upper Valley Lake Sunapee Region<sup>8</sup> and NH DHHS; projected changes in the region's climate were also explored. State and regional data on climate/weather-related impacts on human health were also explored. Based on this, four broad climate-related topic areas (*extreme heat, extreme precipitation, reduced air quality, and vector-borne diseases*) were identified for discussion with the WPHR Healthcare Coalition.

In order to maintain a narrow focus in this plan, the region's two population centers, the cities of Laconia and Franklin were selected as the focal areas based on their population size (30% of the region's population live in these two cities), demographics (includes lower income and limited vehicle households), and resources (the region's major health facilities).

Information on past weather and climate patterns, projected regional climate data, and information about the four topic areas were presented to the WPHR Healthcare Coalition. The group was also presented with demographic and social vulnerability information about

**Priority Climate Risks  
in the Lakes Region:**

Upon review of applicable data and discussion of local conditions, the two regional health risks that the committees agreed should be the focus of this planning effort are heat stress and Lyme disease.

the study communities of Laconia and Franklin and how these social determinants may be related to the topic areas. The WPHR Healthcare Coalition was asked to discuss: (1) regional health risks (2) potential vulnerable populations, (3) mitigating assets and resources, and (4) potential mitigation strategies. The Coalition was also asked to prioritize the impacts, populations, and strategies. The following week the Public Health Emergency Council considered similar information. While there were some differences in the aspects that each group emphasized in their discussion, both groups recommended that the focus of the project be on heat stress and Lyme disease.

Information on the four topic areas and the vulnerable populations are presented in the remainder of this section. The process of prioritization is captured in the matrices that follow at the end of this section (Tables 7 and 8).

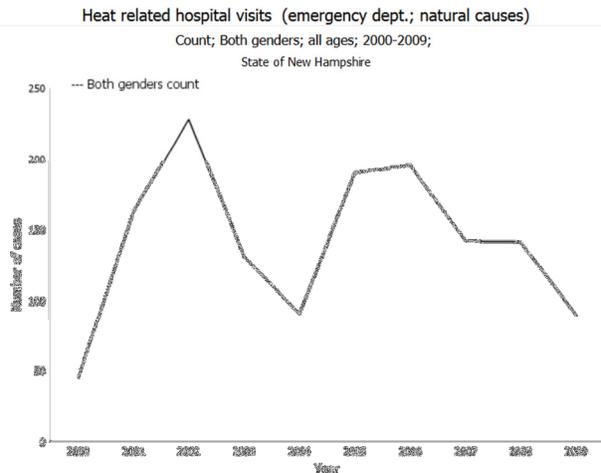
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<sup>8</sup> The Upper Valley Regional Public Health Network was the other PHN in New Hampshire awarded a National Center for Environmental Health grant for studying the impact of climate change on public health and developing an actopn plan to address it.

4.2. Regional health risks

- Excess heat events, heat stress and heat-related illness

There are a variety of heat-related illnesses ranging from cramps to heat exhaustion to sunstroke that can affect people. While regional data were not available for this report, from 2000 to 2009 the number of heat-related hospital visits in New Hampshire each year varied from 50 to more than 220, averaging 127 per year. The number of hospitalizations followed a similar pattern ranging from 1 to 11 per year, averaging seven per year. During that time there were eight deaths attributed to heat in the state<sup>9</sup>.



**Figure 3: Heat-related hospital visits (ED), New Hampshire**

- Extreme precipitation - flooding & washouts

The impact of extreme precipitation events on the health of people in Laconia, Franklin, and the Lakes Region is difficult to quantify. Injuries and deaths associated with this are rare or difficult to capture from existing health data sources. An August 2008 heavy rainfall event in Ashland, NH resulted in flash flooding along a small brook washing an SUV several hundred feet and killing a 7-year-old girl inside<sup>10</sup>. No other data was found linking injuries to heavy rainfall. When local hazard mitigation plans reference heavy precipitation events, the focus tends to be on the continuity of infrastructure and ability to provide emergency response services.

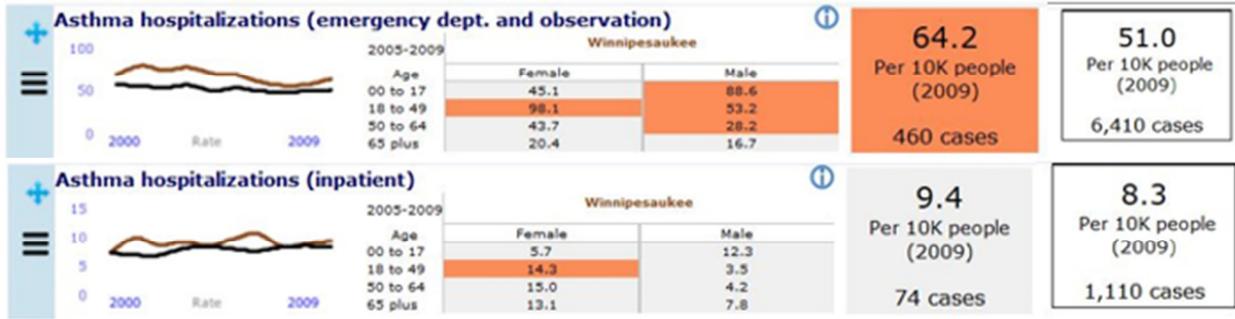
- Reduced Air quality – asthma, and allergies

In 2009 (the most current date for which data is available), there were 460 reports of emergency department and observations for asthma in the Winnepesaukee Public Health Region (WPHR). This equates to 64.2 cases per 10,000 people, which was well above the state average of 51 cases per 10,000 people. The rate of outpatient asthma cases was significantly higher than the state average, especially for men. The rate of inpatient asthma cases was just slightly above the state average for younger women (Figure 4)<sup>11</sup>.

<sup>9</sup> NH Health WISDOM (DHHS), [http://wisdom.dhhs.nh.gov/wisdom/#Topic\\_8537\\_Anon](http://wisdom.dhhs.nh.gov/wisdom/#Topic_8537_Anon).

<sup>10</sup> USA Today, [http://usatoday30.usatoday.com/news/nation/2008-08-08-NH-floods\\_N.htm](http://usatoday30.usatoday.com/news/nation/2008-08-08-NH-floods_N.htm).

<sup>11</sup> NH Health WISDOM (DHHS) <http://wisdom.dhhs.nh.gov/wisdom>.

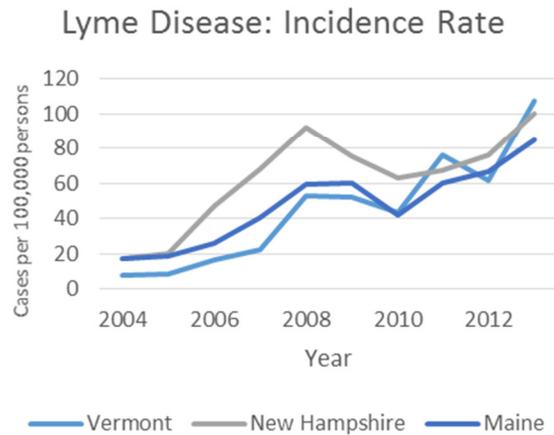


**Figure 4: Asthma hospitalizations by gender and age, WPHR**

- *Habitat change – vector-borne diseases*

The reduction in number of days where the temperature drops below freezing, the reduction in snow-cover, and the extended growing seasons all point to an environment that is much more conducive to mosquitoes and ticks<sup>12</sup>. These environmental changes may lead to an expansion of the mosquito and tick populations and increase the number of days when these vectors are active. In turn, that could lead to an increase in the diseases that are transmitted by vectors (vector-borne diseases) such as Eastern Equine Encephalitis (EEE), West Nile Virus (WNV), and Lyme disease.

While the Lakes Region certainly has mosquitoes, there have been very few human cases of EEE and West Nile Virus reported. Between 2000-2014 six human cases of WNV state-wide including one in the WPHR, and nine human cases of EEE state-wide, none in the WPHR from 2004-2014<sup>13</sup>. The region also has black-legged ticks which carry and transmit the bacterium that causes Lyme disease. Between 2009 and 2014 New Hampshire averaged 1,439 cases/year and Maine, Vermont,

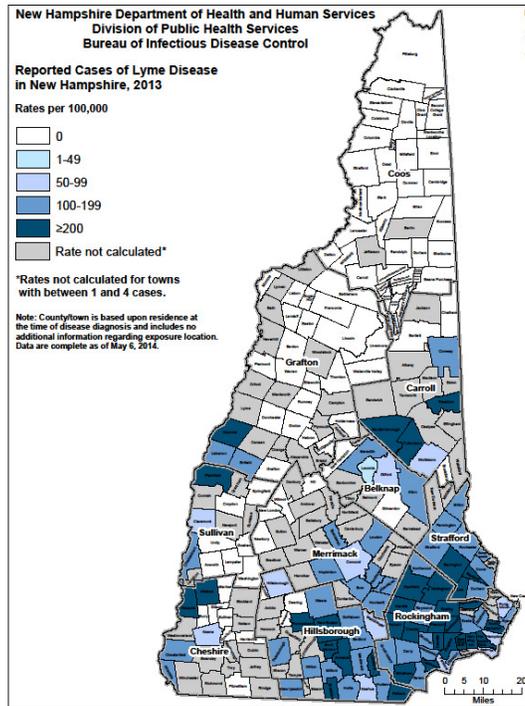


**Figure 5: Incidence of Lyme disease in northern New England**

<sup>12</sup> For ticks, a reduction in questing activity occurs when the temperature falls below 41°F. Two hard frosts ( $\leq 28^\circ\text{F}$ ) will kill off mosquitoes. Source: NH DHHS Bureau of Infectious Disease Control staff, February, 2016

<sup>13</sup> Source: NH DHHS Bureau of Infectious Disease Control staff February, 2016.

and New Hampshire had the highest rates of Lyme disease in the country<sup>14,15</sup>. It is also interesting to note that the Centers for Disease Control (CDC) estimate that only 10% of diagnosed cases of Lyme disease actually get reported to public health officials<sup>16</sup>. Extension of the active tick season by several weeks will likely mean more cases seen by medical offices around the region.



**Figure 6: Reported Cases of Lyme disease, 2013**

According to the map at left, New Hampshire's Seacoast and Southeast regions had the highest rates of Lyme disease cases in 2013; however, several Lakes Region communities had moderate to high rates, ranging from 1-49 cases per 100,000 people in Laconia, 50-99 per 100,000 people in Gilford and Wolfeboro, to greater than 200 cases per 100,000 people in Moultonborough and Tuftonboro, with Meredith and Alton in between. This pattern also correlates closely with fragmented landscapes (forested areas that have been opened up by roads and other development). Fragmented landscape is suitable deer and tick habitat, and the location of fragmented landscapes coincides with where most people live in NH.<sup>17</sup>

- *Emergency Preparedness or Community Resilience*

Members of the Public Health Emergency Planning Council noted that with the increasing severity of storms, there are more and more instances of flooding, road washouts, and downed trees and wires. It is under these circumstances that many calls for assistance are made. In many cases people will have lost power. When communities, businesses, homeowners, and residents take steps to mitigate their property and infrastructure against hazard events, they reduce the impacts from these events<sup>18</sup>. Likewise, being prepared for the health impacts associated with natural hazard

<sup>14</sup> State of New Hampshire Tickborne Disease Prevention Plan (2015)

<http://www.dhhs.state.nh.us/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf>

<sup>15</sup> Note: The CDC Case Definition for Lyme disease changed in 2008 and 2011, which is important when looking at temporal trends. For more information: <http://www.cdc.gov/nndss/conditions/lyme-disease/case-definition/2008/>.

<sup>16</sup> Centers for Disease Control and Prevention <http://www.cdc.gov/lyme/stats/index.html>

<sup>17</sup> State of New Hampshire Tickborne Disease Prevention Plan (2015)

<http://www.dhhs.state.nh.us/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf>

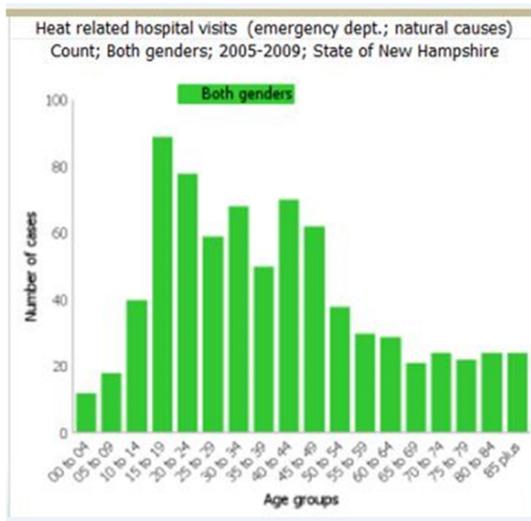
<sup>18</sup> FEMA website, *Mitigation's Value to Society* <http://www.fema.gov/what-mitigation> & *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, [http://www.nibs.org/?page=mmc\\_projects#nhms](http://www.nibs.org/?page=mmc_projects#nhms).

events is prudent and applicable for all in the community. While it is important to be prepared for and to take steps to mitigate against hazard events, emergency preparedness is not by itself a health risk factor. Relevant health outcomes may include carbon monoxide poisoning, gastrointestinal illness, and traffic accidents.

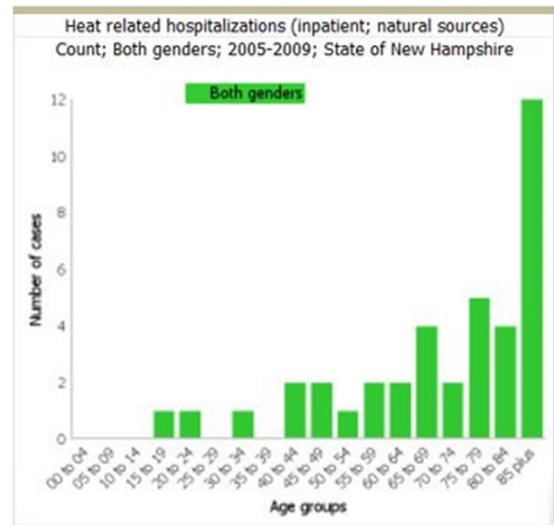
4.3. Vulnerable Populations

- *Excess heat events*

The elderly and the young are usually considered the most at risk for heat stress and heat-related illnesses. However, state-wide data indicate that those aged 15-49 account for the greatest number of hospital visits due to heat (Figure 7). Those over 65 do account for the majority of people *admitted* to the hospital for heat-related illness (Figure 8)<sup>19</sup>.



**Figure 7: Heat-related hospital visits (ED) by age group, New Hampshire**



**Figure 8: Heat-related hospital visits (inpatient) by age group, New Hampshire**

The number of 15-49 year-olds and their proportion of the region’s population are projected to decrease somewhat over the next several decades (Table 3). In this region, the population over 65 is projected to more than double in size and proportion, comprising more than 30% of the region’s population by the year 2040 (Table 4).

**Table 3: Projected number and percent of 15-49 year-olds in Belknap and Merrimack Counties<sup>20</sup>**

<sup>19</sup> NH Health WISDOM (DHHS) <http://wisdom.dhhs.nh.gov/wisdom>.

<sup>20</sup> Ibid.

<b>Belknap</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>3040</b>
<b>Total</b>	60,088	62,678	65,852	67,269
15-49	25,238	23,114	23,739	23,151
15-49 (%)	42.0%	36.9%	36.0%	34.4%
<b>Merrimack</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>
<b>Total</b>	146,445	150,652	157,495	159,845
15-49	67,900	62,424	62,765	60,782
15-49 (%)	46.4%	41.4%	39.9%	38.0%

**Table 4: Projected number and percent of seniors in Belknap and Merrimack Counties<sup>21</sup>**

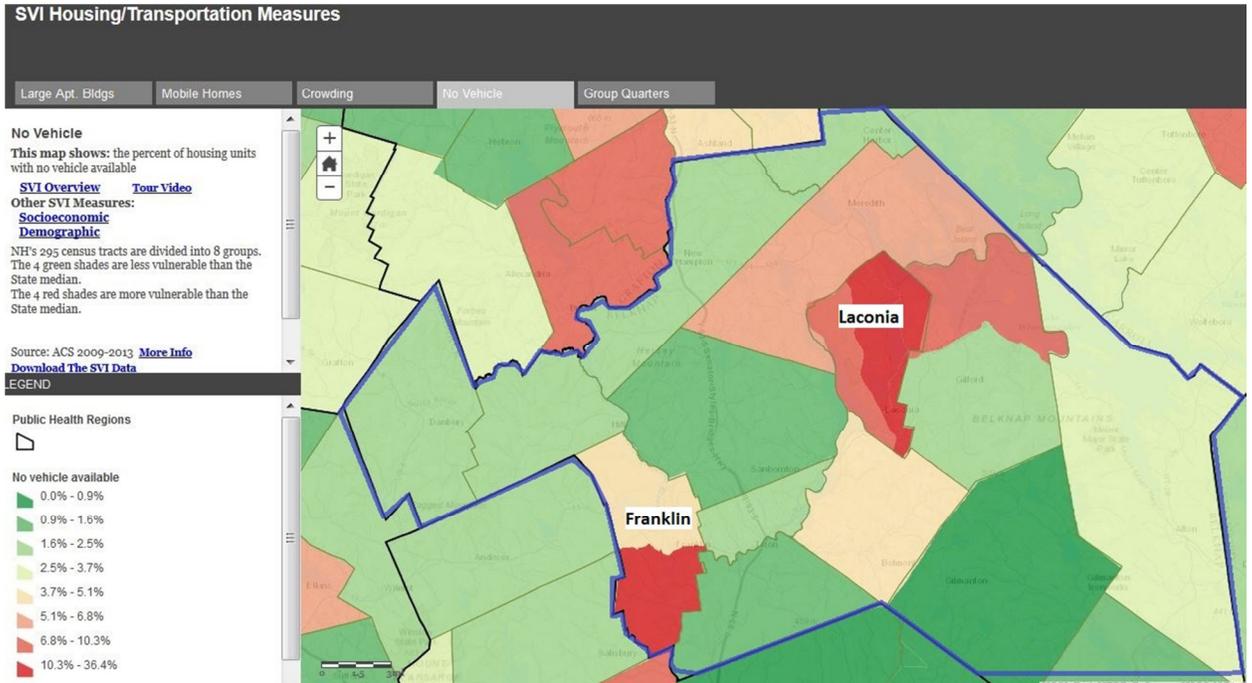
<b>Belknap</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>
<b>Total</b>	60,088	62,678	65,852	67,269
65+	10,057	14,586	19,878	21,401
65+ (%)	16.74%	23.27%	30.19%	31.81%
<b>Merrimack</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>
<b>Total</b>	146,445	150,652	157,495	159,845
65+	20,008	30,379	43,749	48,703
65+ (%)	13.66%	20.17%	27.78%	30.47%

- Extreme precipitation – flooding and washouts*

Those living or working in floodplains, those dependent upon medical oxygen (susceptible to loss of power), and perhaps those without access to a car are at greater risk than others to the effects of an extreme precipitation event and subsequent flooding. Figure 9 indicates that the people in southern Franklin and eastern Laconia are least likely to have access to a vehicle<sup>22</sup>. No other data was found indicating that a particular segment of the population was at any greater risk to hazards associated with extreme precipitation based on age or physical condition.

<sup>21</sup> Population Projections for New Hampshire Counties (2013) <http://www.nh.gov/oep/data-center/documents/2013-projections-state-counties.pdf>.

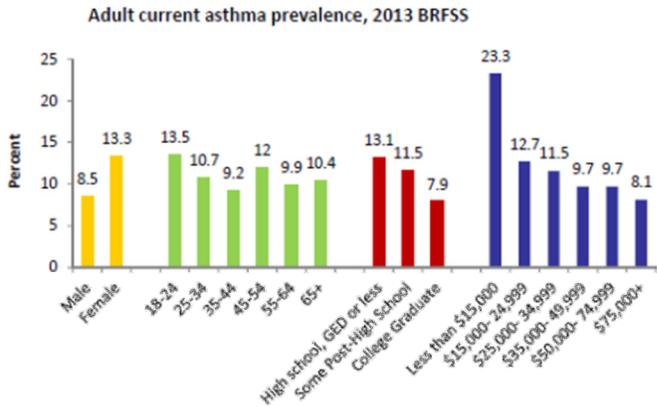
<sup>22</sup> Social Vulnerability Index, <http://nhdphs.maps.arcgis.com/home/>.



**Figure 9: Percent of Households with no access to a vehicle, WPHR**

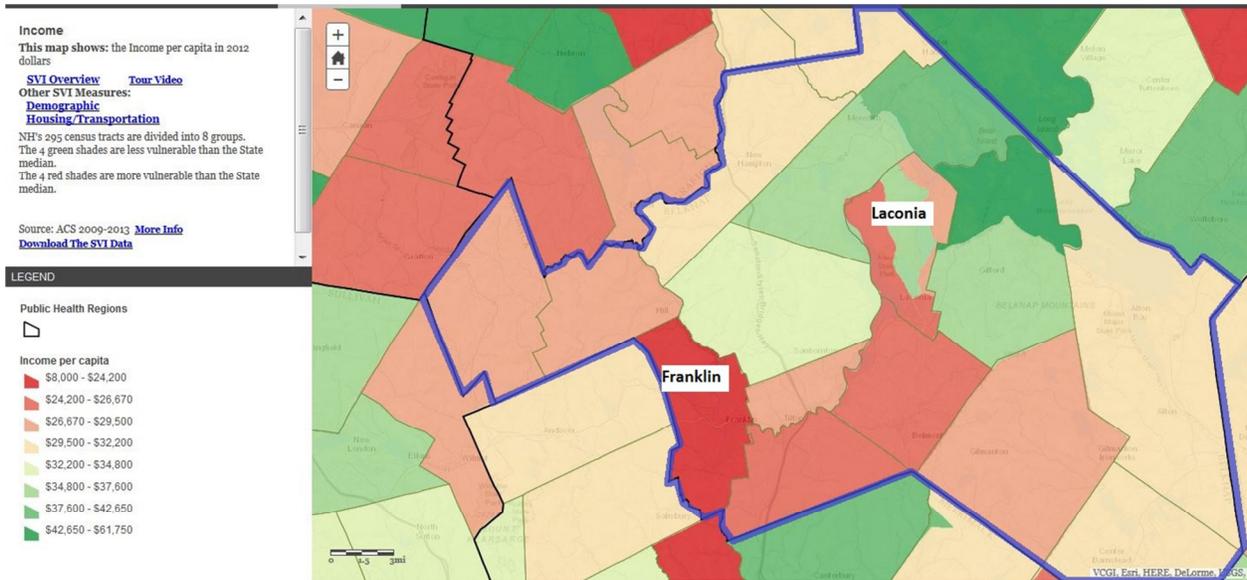
- Reduced Air Quality - asthma*

The 2015 *Asthma Burden Report Update for New Hampshire* reported that the prevalence of asthma in adults in the state was significantly higher than the national average. Within New Hampshire several other patterns were clear; certain women were significantly more likely to have asthma, especially those without a college education and those earning less than \$15,000 per year (Figure 10).<sup>23</sup>



**Figure 10: Asthma prevalence in NH, 2013**

<sup>23</sup>*Asthma Burden in NH, 2014* NH Division of Public Health Services through the NH Department of Public Health, p.8.



**Figure 11: Income per Capita, WPHR**

Figure 11 indicates that Franklin, and to a lesser degree western Laconia, has some of the lowest income households in the region<sup>24</sup>. Table 5 below, “Economic Measures” shows that more than 20% of Franklin’s residents are living in poverty.

**Table 5: Economic Measures**

Economic Measures <sup>25</sup>	Franklin	Laconia	New Hampshire
Median Household Income (MHI)	\$41,702	\$47,684	\$64,916
Percent of State MHI	64%	74%	n/a
Per capita Income	\$21,270	\$28,303	\$33,134
Percent living below poverty level	21%	15%	8.7%

As noted earlier (Figure 4), within the Winnepesaukee Public Health Region, Emergency Department visits and observations associated with asthma occurred at a much higher rate than the state average, especially for males.

- *Habitat change and vector-borne diseases*  
School-aged children, especially those ages 5-14 are most susceptible to Lyme disease<sup>26</sup>, likely because they are apt to spend the most time out of doors and tend to play in

<sup>24</sup> Social Vulnerability Index (SVI) - <http://nhdphs.maps.arcgis.com/home/>

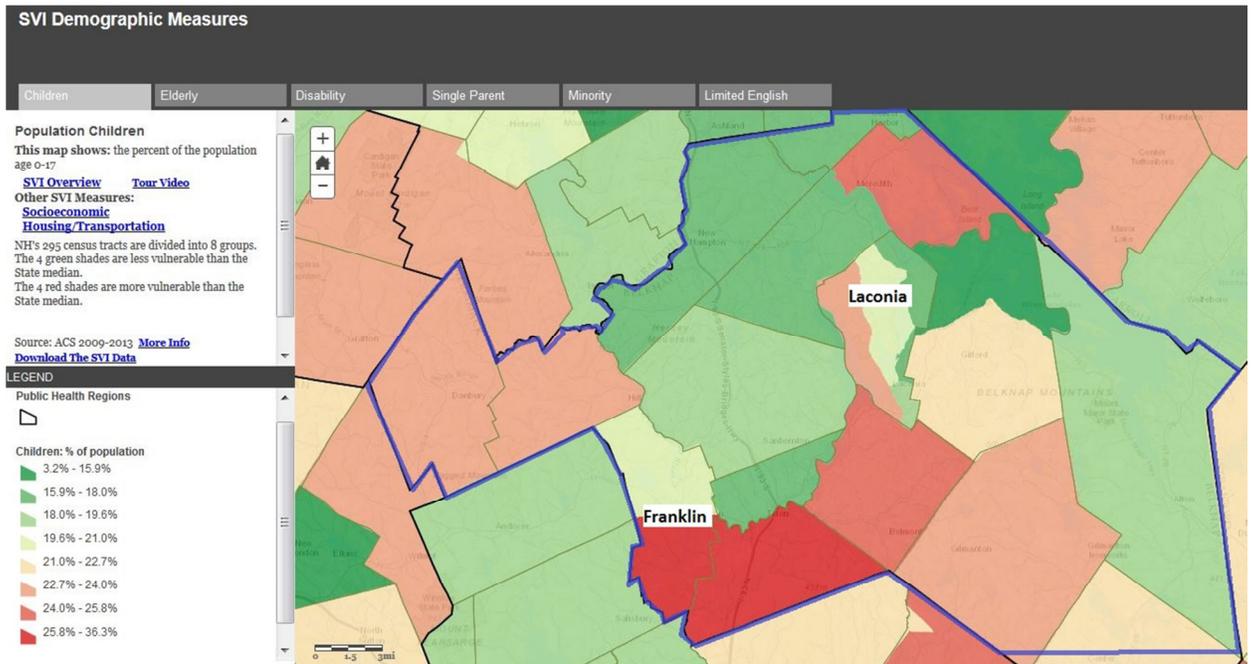
<sup>25</sup> From NH Employment Security, <http://www.nhes.nh.gov/elmi/products/cp/profiles-htm/> and US Census Quickfacts <http://quickfacts.census.gov/qfd/states/33000.html>.

high-tick areas such as the woods or edge habitat. Currently, the 5-14 year-old age group makes up approximately 12% of the region's population (Table 6). The number of children in this age group and their proportion of the population are projected to decrease slightly over the next several decades.

**Table 6: Projected number and percent of 5-14 year-olds in Belknap and Merrimack Counties<sup>27</sup>**

Belknap	2010	2020	2030	2040
<b>Total</b>	60,088	62,678	65,852	67,269
5-14	6,984	7,018	6,856	6,657
5-14 (%)	11.62%	11.20%	10.41%	9.90%
<b>Merrimack</b>				
<b>Total</b>	146,445	150,652	157,495	159,845
5-14	18,047	16,111	15,849	15,190
5-14 (%)	12.32%	10.69%	10.06%	9.50%

The proportion of the population that is under age 18 varies quite a bit by community, with the greatest proportion in southern Franklin and Northfield<sup>28</sup> (Figure 12).



**Figure 12: Proportion of population under age 18, WPHR**

<sup>26</sup> State of New Hampshire Tickborne Disease Prevention Plan (2015), p. 28.

<http://www.dhhs.state.nh.us/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf>

<sup>27</sup> Population Projections for New Hampshire Counties (2013) <http://www.nh.gov/oep/data-center/documents/2013-projections-state-counties.pdf>.

<sup>28</sup> Social Vulnerability Index (SVI) - <http://nhdphs.maps.arcgis.com/home/>

- *Vulnerability Assessment and Prioritization*

The Hazard Vulnerability Assessment matrix (Table 7) summarizes the information that was presented to the advisory committees and how they prioritized the hazards. The Vulnerable Populations matrix (Table 8) focuses on the people and places in the WPHR that are likely to be most vulnerable to the various health impacts identified.

Lyme disease and heat stress were the highest rated hazards associated with our changing climate. There are a number of population groups that are vulnerable to heat stress. The young and adults who recreate or work outdoors are most susceptible to Lyme disease. The goals, objectives, and strategies enumerated in Section 5 are based upon this information.

**Table 7: Hazard Vulnerability Assessment**

<b>Climate Exposure or Vulnerability</b>	<b>Pathways: direct &amp; indirect</b>	<b>Health Effects &amp; Impacts</b>	<b>Evidence for Regional Relevance</b>	<b>Data Source</b>	<b>Regional Priority</b>
Increase in extreme heat events (days over 90 F).	Increase in outdoor & indoor heat. Outdoor workers & people without cooling suffer heat stress.	Heat stress (heat stroke, cramps, heat exhaustion) and death	Climate models indicate the number of days > 90 F may increase 50% by 2040. By the end of the century this could increase to 3 (low) to 9 (high) times the current number.	<i>Climate Change in Southern New Hampshire</i> (2014), NH WISDOM	<b>High:</b> Health risks are clear, especially among vulnerable populations.
Longer Growing Season	Increase in the number of days over 32F, extending the season for disease vectors such as ticks and mosquitos.	Increase in incidence of vector-borne diseases.	New Hampshire already has one of the highest rates of Lyme Disease in the country.	<i>Climate Change in Southern New Hampshire</i> (2014), Centers for Disease Control (2015)	<b>High</b> for Lyme Disease, <b>Low</b> for others.
Increase in extreme precipitation events (>4" in 48 hours)	Increase in the number of days with heavy rain or snowfall. This could result in increased flooding, power outages, and road washouts.	Injury and death (drowning) are the direct health impacts. Secondary impacts might result from limited power service (heating, cooling, & oxygen) and emergency services.	The number of extreme precipitation events in the region has increased each of the past four decades. Models indicate that the number of days will increase 50% by 2040. By the end of the century this figure is projected to double.	<i>Climate Change in Southern New Hampshire</i> (2014)	<b>Low to Medium</b> , the secondary impacts were the greatest concern.
Longer Growing Season	Increase in the number of days over 32F, allergic plants bloom earlier and later, people have more days of exposure and inhale greater amounts of pollen.	Increase in respiratory diseases, increased asthma occurrence and severity.	Models indicate that the growing season will be 5-9% longer by 2040. By the end of the century it is expected that the season will be between 10-30% higher.	<i>Climate Change in Southern New Hampshire</i> (2014)	<b>Low:</b> Health risk is high, yet the state asthma program is strong.

**Table 8: Vulnerable Populations**

<b>Climate Exposure or Vulnerability</b>	<b>Pathways: direct &amp; indirect</b>	<b>Health Effects &amp; Impacts</b>	<b>Vulnerable Populations &amp; Places</b>	<b>Evidence of Risk for Focus Populations</b>	<b>Locations of Populations at Risk</b>
Increase in extreme heat events (days over 90 F).	Increase in outdoor & indoor heat. Outdoor workers & people without cooling suffer heat stress.	Heat stress (heat stroke, cramps, heat exhaustion) and death	<b>People aged 15-49, elderly.</b> People without AC. People with lower income.	NH WISDOM, Social Vulnerability Index (SVI)	Meredith, Tilton, E. Laconia, Gilford, Sanbornton, Franklin, Northfield, Belmont, Gilmanton
Longer Growing Season	Increase in the number of days over 32F, extending the season for disease vectors such as ticks and mosquitos.	Increase in incidence of vector-borne diseases.	<b>Children ages 5-14</b> and adults who work and recreate outdoors	<i>State of New Hampshire Tickborne Disease Prevention Plan, 2015, SVI</i>	S. Franklin, Northfield, W. Laconia, Belmont, Gilmanton
Increase in extreme precipitation events (>4" in 48 hours)	Increase in the number of days with heavy rain or snowfall. This could result in increased flooding, power outages, and road washouts.	Injury and death (drowning) are the direct health impacts. Secondary impacts might result from limited power service (heating, cooling, & oxygen) and emergency services.	People living within the floodplain. Elderly people. Those with limited transportation options (no vehicle). People on low incomes.	SVI, Hazard Mitigation Plans & National Flood Insurance Program	S. Franklin, Laconia, N. Gilford, Mer., Mer., Tilton, Center Harbor, E. Laconia, Gilford, Sanbornton
Longer Growing Season	Increase in the number of days over 32F, allergic plants bloom earlier and later, people have more days of exposure and inhale greater amounts of pollen.	Increase in respiratory diseases, increased asthma occurrence and severity.	People with asthma and other respiratory diseases. People in low-income households. Note: WPHR has a much higher rate of asthma than the state average.	<i>Asthma Burden in NH, 2014; NH WISDOM</i>	Franklin, W. & E. Laconia, North. Belmont, Tilton

## 5. Goals, objectives, strategies, and implementation

As noted earlier in this plan, the Healthcare Coalition of the WPHR directed the focus of this work towards heat stress and Lyme disease. In subsequent consultation with DHHS staff, the focus was narrowed to just one health impact, Lyme disease. Five goals were identified along with multiple objectives and strategies for each goal.

- Goal 1 – Increase awareness and recognition of Lyme disease and prevention among youth, ultimately leading to fewer cases.
- Goal 2 – Increase awareness and recognition of Lyme disease and prevention among adults, ultimately leading to fewer cases.
- Goal 3 – Increase awareness and recognition of Lyme disease and prevention among tourists, ultimately leading to fewer cases.
- Goal 4 – Increase awareness of how to reduce exposure to black-legged ticks through land management techniques.
- Goal 5 – Improve awareness of local cases and needs related to monitoring Lyme disease.

To achieve these goals, several objectives were defined and specific short- and longer-term strategies developed to work towards implementing in order to help communities in the region. In achieving these goals, the people of this region will be less susceptible to the impacts of Lyme disease and better prepared for the impacts of a changing climate in New England.

<b>Goal 1</b>	<b>Increase awareness and recognition of Lyme disease and prevention activities among youth, ultimately leading to fewer cases.</b>
<b>Objective 1</b>	<b>Within six months, 75% of the youth recreation associations have knowledge of the NH Tick-bourne Disease Prevention Plan and access to related resources.</b>
<b>Strategy 1</b>	Identify the various youth recreation associations in the target communities and the appropriate contacts.
<b>Strategy 2</b>	Gauge the extent of current practices. This may include coordination with other efforts around the state to gauge tick and Lyme disease awareness and prevention.
<b>Strategy 3</b>	Work with DHHS to identify appropriate resources and methods of raising awareness known to be effective with this population (youth).
<b>Strategy 4</b>	Work with stakeholders to identify appropriate communication methods and outreach, including opportunities for future engagement.
<b>Strategy 5</b>	Present information to leaders of youth recreation programs ("train the trainers").

Health & Climate Change in New Hampshire's Lakes Region: An Action Plan

<b>Objective 2</b>	<b>Within 12 months, 75% of the area's health educators (in hospitals, schools, community health centers, and veterinarians) have knowledge of the NH Tick-bourne Disease Prevention Plan and access to related resources.</b>
<b>Strategy 1</b>	Identify the various health educators in the target communities and the appropriate contacts.
<b>Strategy 2</b>	Gauge the extent of current practices. This may include coordination with other efforts around the state to gauge tick and Lyme disease awareness and prevention.
<b>Strategy 3</b>	Work with DHHS to identify appropriate resources and methods of raising awareness known to be effective with this population (youth).
<b>Strategy 4</b>	Work with stakeholders to identify appropriate communication methods and outreach, including opportunities for future engagement.
<b>Strategy 5</b>	Present information to health educators ("train the trainers").

<b>Goal 2</b>	<b>Increase awareness and recognition of Lyme disease and prevention activities among adults ultimately leading to fewer cases.</b>
<b>Objective 1</b>	<b>Within 12 months, 75% of the adult recreation associations and large employers with outdoor workers have knowledge of the NH Tick-bourne Disease Prevention Plan and access to related resources.</b>
<b>Strategy 1</b>	Identify the various recreation associations and large employers with outdoor workers in the target communities and the appropriate contacts.
<b>Strategy 2</b>	Gauge the extent of current practices. This may include coordination with other efforts around the state to gauge tick and Lyme disease awareness and prevention.
<b>Strategy 3</b>	Work with DHHS to identify appropriate resources and methods of raising awareness known to be effective with this population (adults).
<b>Strategy 4</b>	Work with stakeholders to identify appropriate communication methods and outreach, including opportunities for future engagement.
<b>Strategy 5</b>	Present information to leaders of recreation programs and large employers ("train the trainers").

<b>Objective 2</b>	<b>Within 18 months, 75% of the small employers with outdoor workers have knowledge of the NH Tick-bourne Disease Prevention Plan and access to related resources.</b>
<b>Strategy 1</b>	Identify the various small employers with outdoor workers in the target communities and the appropriate contacts.
<b>Strategy 2</b>	Gauge the extent of current practices. This may include coordination with other efforts around the state to gauge tick and Lyme disease awareness and prevention.
<b>Strategy 3</b>	Work with DHHS to identify appropriate resources and methods of raising awareness known to be effective with this population (adults).
<b>Strategy 4</b>	Work with stakeholders to identify appropriate communication methods and outreach, including opportunities for future engagement.
<b>Strategy 5</b>	Present information to leaders of small employers ("train the trainers").

Health & Climate Change in New Hampshire's Lakes Region: An Action Plan

<b>Goal 3</b>	<b>Increase awareness and recognition of Lyme disease and prevention activities among tourists, ultimately leading to fewer cases.</b>
<b>Objective 1</b>	<b>Within 12 months, 75% of the adult recreation associations and large employers with outdoor workers have knowledge of the NH Tick-bourne Disease Prevention Plan and access to related resources.</b>
<b>Strategy 1</b>	Identify the various tourism associations in the target communities and the appropriate contacts.
<b>Strategy 2</b>	Gauge the extent of current practices. This may include coordination with other efforts around the state to gauge tick and Lyme disease awareness and prevention.
<b>Strategy 3</b>	Work with DHHS to identify appropriate resources and methods of raising awareness known to be effective with this population (visiting families).
<b>Strategy 4</b>	Work with stakeholders including DHHS to identify appropriate communication methods and outreach, including opportunities for future engagement.
<b>Strategy 5</b>	Present information to leaders of tourism associations ("train the trainers").
<b>Goal 4</b>	<b>Increase awareness of how to reduce exposure to black-legged ticks through land management techniques.</b>
<b>Objective 1</b>	<b>Within 12 months, 75% of the homeowners associations have knowledge of the land management steps and resources that discourage black-legged ticks.</b>
<b>Strategy 1</b>	Identify the various homeowners associations in the target communities and the appropriate contacts.
<b>Strategy 2</b>	Gauge the extent of current practices. This may include coordination with other efforts around the state to gauge tick and Lyme disease awareness and prevention.
<b>Strategy 3</b>	Work with DHHS to identify appropriate resources and methods of raising awareness known to be effective.
<b>Strategy 4</b>	Work with stakeholders to identify appropriate communication methods and outreach, including opportunities for future engagement.
<b>Strategy 5</b>	Present information to leaders of homeowners' associations ("train the trainers").

<b>Objective 2</b>	<b>Within 18 months, 75% of the landscapers have knowledge of the land management steps and resources that discourage black-legged ticks.</b>
<b>Strategy 1</b>	Identify the various landscapers in the target communities and the appropriate contacts.
<b>Strategy 2</b>	Gauge the extent of current practices. This may include coordination with other efforts around the state to gauge tick and Lyme disease awareness and prevention.
<b>Strategy 3</b>	Work with DHHS to identify appropriate resources and methods of raising awareness known to be effective.
<b>Strategy 4</b>	Work with stakeholders to identify appropriate communication methods and outreach, including opportunities for future engagement.
<b>Strategy 5</b>	Present information to leaders of landscaping businesses ("train the trainers").

Health & Climate Change in New Hampshire's Lakes Region: An Action Plan

<b>Goal 5</b>	<b>Improve awareness of local cases and needs related to monitoring Lyme disease.</b>
<b>Objective 1</b>	<b>Within 18 months, 75% of the healthcare community have knowledge of the need and methods for reporting local cases of Lyme disease.</b>
<b>Strategy 1</b>	Identify the various members of healthcare community and the appropriate contacts.
<b>Strategy 2</b>	Gauge the extent of current tick and Lyme disease reporting practices. This may include coordination with other efforts around the state to gauge tick and Lyme disease reporting.
<b>Strategy 3</b>	Work with DHHS to identify appropriate resources and methods of raising awareness known to be effective in improving case reporting.
<b>Strategy 4</b>	Work with stakeholders, including DHHS to identify appropriate communication methods and outreach related to tick and Lyme disease reporting, including opportunities for future engagement.
<b>Strategy 5</b>	Present information to leaders of the regional healthcare community.

Phase II of this project will be targeted at implementation of the mitigation strategies identified in this plan. As part of this existing funding cycle, there is a very limited time frame for Phase II (January – June 2016), therefore efforts will be focused on the actions in the preceding section that have the highest priority and/or shorter implementation timeline.

## Appendix A - Resources

Discussions were held with the WPHR Healthcare Coalition exploring all four identified health impacts. A variety of resources were identified as potential stakeholders or aids in addressing the health impacts associated with changes in the region's climate.

### Heat Stress

While other areas of the country deal with heat extremes on a regular basis, many people living in or visiting the area choose to be outdoors on the warmest, sunniest days, rather than avoiding them, or adapting to extreme heat.

- A number of adaptation strategies are described in the *New Hampshire's Excessive Heat Plan* <http://www.dhhs.nh.gov/dphs/climate/documents/nh-excessive-heat-plan.pdf>.
- Hospitals and health centers that treat heat stress
  - Hospitals - LRGHealthcare in both Laconia and Franklin
  - Community health centers - HealthFirst in both Laconia and Franklin
- Municipal Cooling Centers identified as resources:
  - The Laconia HMP identifies a couple of cooling centers (Weirs Community Center and Gale Memorial Library) and references an event in 2004 when an extreme heat wave was coupled with a loss of power and consequently loss of water pressure to many housing units and Lakes Region General Hospital.
  - There was no mention of extreme heat or cooling centers in the Franklin HMP.
  - The neighboring town of Tilton does identify extreme heat as a concern in their 2015 HMP with special attention to the Peabody Center, an elderly housing facility for 60-100 individuals with limited cooling capacity and no back-up generator.
- Both Laconia and Franklin have a Senior Center which serves as a trusted source of information and a vehicle for providing outreach to the seniors in the community.
- There are two Visiting Nurse Associations (VNAs) serving these communities – Concord Area VNA for Franklin and Central VNA for Laconia.
- School athletic programs might consider adjusting training and competition schedules to address extreme heat. Likewise city recreation programs should consider reviewing and adjusting their activity schedules and locations to address extreme heat.
- City beaches and swimming pools may be able to provide extended hours of operation or reduced admission rates during heat waves.
- Contacts:
  - SAU 18 (Franklin) Superintendent Robert McKenney 934-3108 [rmckenney@sau18.org](mailto:rmckenney@sau18.org)
  - SAU 30 (Laconia) Interim Superintendent Dr. Phil McCormack 524-5710 [pmccormack@laconiaschools.org](mailto:pmccormack@laconiaschools.org)
  - Franklin Parks and Recreation Director, Krystal Alpers 934-2118 [kalpers@franklinnh.org](mailto:kalpers@franklinnh.org)
  - Laconia Parks and Recreation Director, Kevin Dunleavy 524-5046 [parks@city.laconia.nh.us](mailto:parks@city.laconia.nh.us)

Extreme Precipitation – flooding & washouts

Both the Healthcare Coalition and the Emergency Planning Council acknowledged that there has been and will be an increase in the number of heavy precipitation events and that these may damage infrastructure, compromising both power and emergency response.

- The groups felt that local hazard mitigation plans (HMP) are the best tool for addressing these concerns. All communities in the Winnepesaukee Public Health Region do have an up-to-date HMP (Table 7); to remain valid, plans are updated every five years. Local information about participation in the National Flood Insurance Program (NFIP) and efforts to mitigate flooding in floodplains are required elements of the hazard mitigation plan.

**Table 9: Hazard Mitigation Plan Status**

Community	HMP Year	Next Update Due Date	NFIP Participant
Laconia	2012	2017	Y
Franklin	2013	2018	Y
Alton	2011	2016	Y
Barnstead	2014	2019	Y
Belmont	2014	2019	Y
Center Harbor	2014	2019	Y
Danbury	2014	2019	Y
Gilford	2013	2018	Y
Gilmanton	2012	2017	Y
Hill	2014	2019	Y
Meredith	2015	2020	Y
Moultonborough*	2013	2018	Y
New Hampton	2015	2020	Y
Northfield	2012	2017	Y
Sanbornton	2014	2019	Y
Tilton	2015	2020	Y

\*Part of this region for Emergency Management purposes only.

Resources for Reduced Air Quality – asthma, allergies

The group acknowledged that with fewer snow-covered days and a longer growing season that the conditions will be ripe for an increase in the number of asthma and allergy cases.

## Health & Climate Change in New Hampshire's Lakes Region: An Action Plan

- The Healthcare Coalition determined that the Department of Health and Human Services and regional providers are doing a very good job of addressing environmental factors through the *State Asthma Plan 2015-2019*<sup>29</sup>.
- There is a need to determine if current pollen and fungi reports are adequate to inform the regional populations. No allergen collection stations are currently located in the Lakes Region.

### Resources for Habitat change – vector-borne diseases

With fewer days of snow-cover and fewer days below freezing, the Healthcare Coalition agreed that these conditions would increase the likelihood that deer ticks would survive and be active for longer periods of time and that residents and visitors would be more likely to be in situations where the ticks attach to people and likely transmit the disease.

- Local recreation programs may be a resource for improving tick-safe behaviors, or changing landscaping to reduce exposure
- Hospitals and health centers may be a resource to educate the population about risk reduction strategies, identify ticks, and treat exposures
- Outdoor clubs may be a resource for at-risk populations
- The Cornell Integrated Pest Management program is a resource for reducing ticks through landscape management practices  
[http://nysipm.cornell.edu/%5C/whats\\_bugging\\_you/ticks/default.asp](http://nysipm.cornell.edu/%5C/whats_bugging_you/ticks/default.asp)
- The New Hampshire Tickborne Disease Prevention Plan (2015) is a resource for understanding tickborne disease, changes in risk factors, prevention and control, educational outreach, and surveillance  
<http://www.dhhs.state.nh.us/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf>
- City of Nashua *Lyme Disease Toolkit*<sup>30</sup>
- VT webpage <http://lymediseaseguide.org/>
- VT high school media competition  
<http://www.wcax.com/story/29495631/vt-students-winning-tick-smart-video>
- VT Tick Tracker app <http://lymediseaseguide.org/vermont-unveils-tick-tracker>

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<sup>29</sup> <http://www.dhhs.state.nh.us/dphs/cdpc/asthma/documents/state-plan.pdf>

<sup>30</sup> *Nashua Lyme Disease Toolkit*

<http://www.nashuanh.gov/CityGovernment/Departments/PublicHealthCommunityServices/CommunityServicesDepartment/HealthEducationandPreventionServices/LymeDiseaseToolkit/tabid/1176/Default.aspx>